VERIFIED PERSPECTIVE
AND
THE PERSPECTOGRAPH

BY

ATUL BOSE

G. P. GHOSH SCHOLAR (CALCUTTA UNIVERSITY); STUDENT, ROYAL ACADEMY OF ARTS (SCHOOL OF PAINTING), LONDON; PAINTER OF ROYAL PORTRAITS FROM BUCKINGHAM PALACE AND WINDSOR CASTLE, UNDER GOVT. OF INDIA COMMISSION; SOMETIME TEACHER-IN-CHARGE, GOVT. SCHOOL OF ART, CALCUTTA.

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TO

THE REVERED MEMORY OF

Sir Asutosh Mookerjee

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FOREWORD

In writing this book my primary object is to suggest a practical means of both realising the laws of visual perspective and applying them in making correct drawings.

The generalised principle or the law of perspective is that, given a fixed standpoint—in other words, if we stand firmly on a spot and look straight ahead—we see the nearest object as the largest, and conversely, the farthest one as the smallest. The mode of rendering these objects on our canvas not as they are, but as they appear to our vision, is the art of drawing in perspective. The process of such rendering may obtain great help by the use of an apparatus I have designed and called the PERSPECTOGRAPH, which is fully described in this book. It should, however, be noted that the use of the Perspectograph is only a means to an end. It can and should be discarded when the principles of perspective are fully realised and the capacity for making correct drawings is acquired.

It is obvious that the book is written for those who intend to become painters or to acquire a basic knowledge of the art of drawing from nature.

74, BONDEL ROAD,
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June 21, 1944.

ATUL BOSE

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CHAPTER I

ALPHABETS OF NATURE

THE belief that anybody who can write the letters of an alphabet, should also be able to draw from nature equally well, has induced me to write this book. By drawing from nature, I mean here the ability to depict correctly, on a flat surface, that aspect of nature which is extended away from us to the horizon and which, broadly speaking, is also known as drawing in perspective.

The first and foremost argument to substantiate my belief is that the mere writing of alphabetical characters involves the ability to draw something over fifty figures of different sizes and shapes, transverse, oblique or vertical, and even a fair amount of unconscious knowledge of putting them in the right sequence and in the right place. My next point is that drawing from nature does not involve a more intimate perception of distinct forms or a greater capacity to depict them significantly. All that matters is the fact that one uses the visual instead of preconceived ideas of symbols or images. I have no desire to refer to the physical and mental bases of the perception of images, nor to discuss whether such images at all fall within the range of either or both bases. I propose, in this book, to put forward some hints and suggestions, to make obvious the laws of perspective with the aid of an apparatus which I have called the "PERSPECTOGRAPH." This apparatus, I sincerely hope, will enable us to read correctly the alphabet of nature as seen with open eyes right in front of us, so that we may also be able to write it in black and white. I must offer here a word of apology to artists, devoted entirely to experiments on the aesthetic potency of the line, colour and tone. This very simple apparatus, meant for outdoor or studio experiments, and even as a hobby for amateurs, can hardly claim anything beyond a passing interest from artists who have already acquired the necessary amount of proficiency. It is, after all, one more attempt to make obvious, by practical experiments, the principles underlying the relation of the perceived and the percipient, by supplementing the methods already known.

As is evident from drawings made long before the time of Leonardo da Vinci, practising artists had certain ideas about the principles of perspective, and drawing in perspective, although imperfectly done, was known to the artists of all ages and countries. Two thousand years before Leonardo da Vinci (that is, about 2,500 years ago), it is recorded that " in drawing, the lines ought to be made to correspond, according to a natural proportion, to the figure which would be traced out on an imaginary intervening plane by a pencil of rays proceeding from the eye, as a fixed point of sight, to the several points of the objects viewed." There was at that time an artist at Athens, on whose work such observations were made by a contemporary writer. Even drawings on the walls of Pompeii prove that the Romans, some 1,500 years before da Vinci, "were very well versed (in simple parallel perspective) though without the accuracy we now expect." One would wonder with Vicat Cole "why the credit of discovering perspective should often be given to the early Italians."

Knowledge of perspective has considerably progressed through later scientific researches, although it is confined more or less to art students generally; and as far as I am aware, very little has been done to make it a popular subject, either in theory or in practice. This has induced me to intrude upon matters supposed to be exclusively in the domain of the mathematically and artistically minded.

I do not believe that a man need be very "clever," or "diligent," or "enthusiastic," to learn the art and science of drawing in perspective, inspite of Ruskin's insistence. There were indeed good reasons "to learn perspective by the measures of everything," when Leonardo wrote the first words on it. But, Ruskin four centuries later need not so vehemently have expected us "to master the mathematics of it, and that with *engineer's accuracy*." Fortunately, we have before us "studies in line for portraits" by Holbein, which "are unsurpassed in art for the amount that is conveyed in them by the very slightest means" (Baldwin Brown). Holbein is also unflinchingly accurate, but his "mental activity is different from a drawing done with the cold, mechanical accuracy of a machine." Of course, "engineer's accuracy" is not the inevitable result of the engineer's mentality. There are indeed severe mathematical laws behind almost everything we perceive, but we need not, in search for "vital expressiveness," take the first lessons so severely, I think, as Ruskin has dictated.

The laws of perspective are a few and simple ones, and they can be understood simply yet finally. Most of them can be practically learnt by those who are curious and have a little time at their disposal, with the aid of the apparatus which I have designed for the purpose, and am going to explain here. As I propose to explain almost all the rules mainly by verification, the use of the PERSPECTOGRAPH will be justified.

It is assumed that while "delineating on a plane surface true resemblances of objects, as they appear to the eye from any given distance and situation, real and imaginary," we attempt to draw the contour of objects as if seen through a glass pane right in front of us. We rightly feel that the images, as intercepted on a window pane at a convenient distance, would, if correctly outlined, produce the desired effect as if through the "mirror of the passing world." As it is not possible, nor worth the attempt, to draw images to the actual size that is reflected on the retina, artists usually intercept the image at an imaginary plane, placing the picture plane or the drawing board within a range where they can normally see and conveniently draw. Such a distance is generally from ten inches to an arm's length from the point of view, *viz.*, from the eyes.

Taking this interception of images seen through a transparent piece of glass as our starting point, we can at once proceed by placing right before us a firm telescopic stand supporting two frames of identical size, one holding a piece of glass and the other a drawing board. The framed glass is a substitute for the window pane, and we are to draw only that portion which is intercepted within the frame. For reasons to be explained later, the inside measurement of the frames will be one foot square and their sides may have their surfaces marked into well defined scales in inches; and, for the purpose of easily following the contours as seen through our improvised window, the glass itself may be squared, by drawing vertical and horizontal lines an inch apart with red writing ink. A similarly squared cardboard will then be slipped between the board and the drawing paper on which the picture is to be drawn. The lines on the squared cardboard should be dark enough to show through the drawing paper which, on the other hand, should not be too opaque to obstruct the lines on the cardboard from our vision. Drawing papers, similarly squared, may also be used in the very beginning without the intervening squared cardboard.

We have now the glass frame, the centre of which should preferably coincide with our point of vision (as can be easily adjusted up to our height on the stand). The glass will contain (12×12=) 144 small windows to act as ready-made guides. All we have to do at this stage is to draw mechanically and with a minimum of guess-work the main outlines as imaged on the small windows within the range of, say, a ten-inch square, on the corresponding one hundred one-inch squares of the drawing paper. This is almost akin to tracing, and it, therefore, cannot be difficult to delineate figures enclosed within such small squares with their sides acting as guides. For thôse who are more confident, I would reduce the number to twenty-five two-inch or even to four five-inch squares. This would also save the beginner from squinting in looking through many peep-holes. The sooner one can get over the first stage-shyness, so to speak, and then look straight at the object with bolder eyes, the firmer indeed will one's hold be on the pencil. The horizontal line on the picture plane should, of course, be parallel to the eyes.

We should begin our exercise with simple objects of cuboid and cylindrical forms, such as biscuit tins, books, tumblers and jars. The decorative patterns and letterings should be avoided in these preliminary exercises, although the broad outlines of curves or simple patterns that are generally marked on those articles, may be included. These objects or models should be placed on a platform at such a distance that they may occupy the greater portion of the window frame, but preferably not so near as to touch the frame itself. It is needless to mention that all these simple objects have to be replaced later by natural objects, but it is well to remember that all objects in nature can also be enclosed in imaginary cuboid and cylindrical crates, and to develop this discerning sense by guess-work will in future be of immense value.

CHAPTER II

THE ESSENTIAL CONDITION AND THE FIRST LAW OF DRAWING IN PERSPECTIVE

Now let us try to understand the method of using the PERSPECTOGRAPH, and see how in the process we can verify the laws of perspective.

During his first attempts the observant beginner will find that the slightest shifting of the point of vision (the eyes)—by moving sideways, upwards or downwards—upsets the images as seen in relation to the sides of the corresponding squares, and he will learn that the first essential condition of drawing from nature is TO MAINTAIN THE SAME STANDPOINT. It will also be noticed how the drawings must be done by one eye, as the artist usually does, especially when the objects are near, and that the objects nearer are more affected by the shifting of our standpoint than of those far away. TO MAINTAIN THE SAME STANDPOINT is, after all, only a preliminary physical difficulty. It can be easily overcome if, at the outset, a few points on the corresponding sides of the squares are marked, preferably of an image of a near object in view. These marked points will act as guides to the relative position the percipient has with the perceived objects. The distance from the eye to the drawing board has also to be kept constant, and this can be achieved by standing upright and placing the drawing board at an arm's length—thus locking up the unvarying measurements from the eye both to the board and to the ground with the help of our body. The minute differences that may occur owing to the distance from the centre of the window to the remote squares five inches away (corners extending over five inches should, if possible, be avoided), may be left out for all practical purposes (FIG. 1). But herein lies our next essential point to which I shall come in due course.

If standing upright or keeping the arm stretched for a length of time be not possible, the beginner may sit down and draw at about half the arm's length, say, ten inches away, for which the pair of frames should each be four and a half inches square. Hinged 4½″ square frames can also be carried for ready reference as a pocket model of the PERSPECTOGRAPH.

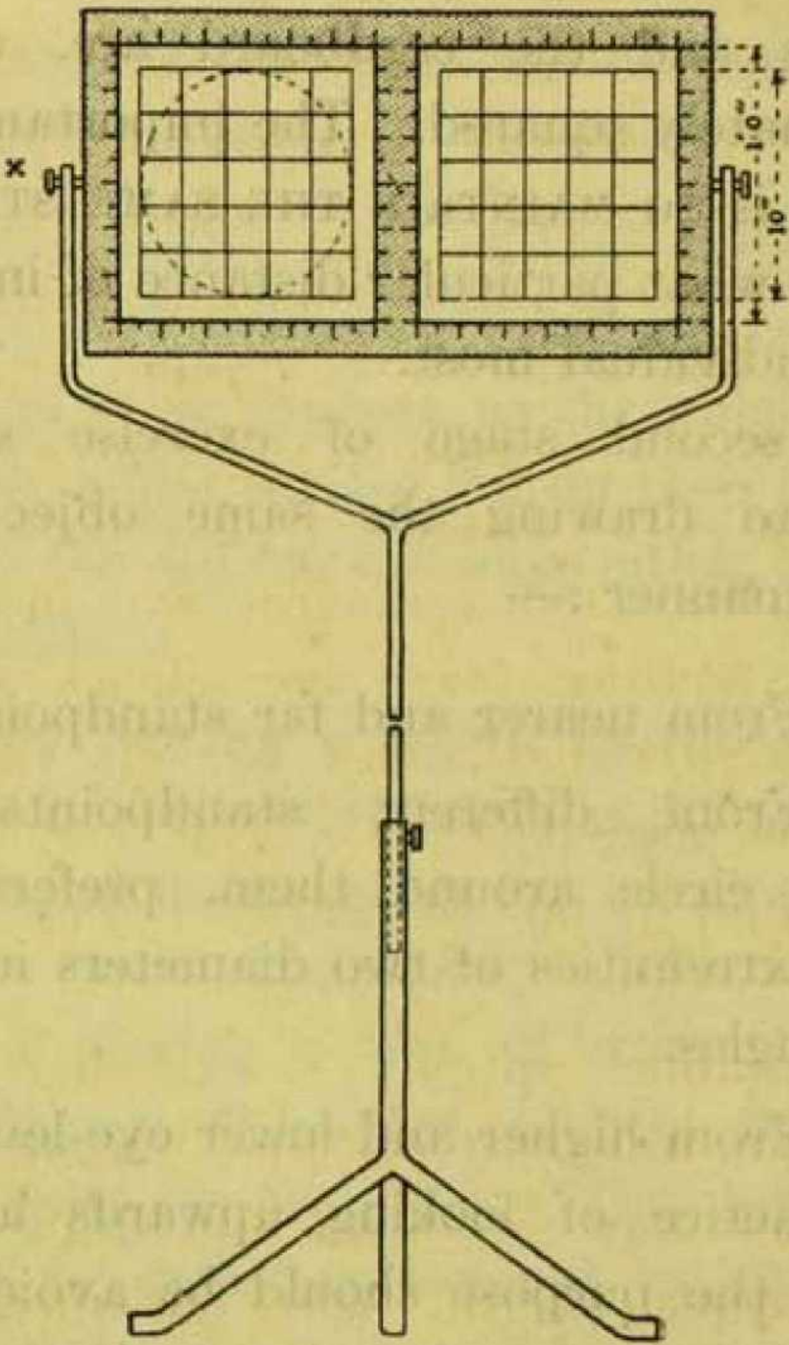

FIG. 1. THE PERSPECTOGRAPH

Showing the glass window on the left and the drawing board on the right, divided by lines into twenty-five 2″ squares; also the 10′ base of the 25° visual cone as intercepted at an arm's length (approx. 2′) from the eye. The screw X enables the tilting of the window and the picture plane upwards and downwards. (See also pages 16 and 31.)

The glass and the cardboard are, of course, proportionately squared. The important point to remember is TO MAINTAIN THE SAME STANDPOINT, no matter what particular distance of interception suits an individual most.

The second stage of exercise should be confined to drawing the same objects in the following manner :—

(1) From nearer and far standpoints.

(2) From different standpoints on an imaginary circle around them, preferably from the four extremities of two diameters intersecting at right angles.

(3) From higher and lower eye-levels. (The wrong practice of looking upwards and downwards for the purpose should be avoided.) The eye-level being the imaginary horizontal line resting on the vertical from the eyes to the ground (theoretically the sea-level) on which the beginner is standing or sitting, he must either

raise or lower his own platform or that on which the models are placed.

(4) (*a*) Giving the objects different tilts, forwards or backwards (which may necessitate the provision of some support, as the objects are not to stand on a flat surface but on their edges); or, (*b*) turning the objects sideways either to the right or to the left.

(5) By placing a mirror at the side of the objects in a position either upright or at a tilt, and by placing it altogether flat under the objects. Reflections and refractions in water may be studied by placing a tray of water in front of the objects, or with other objects floating and half-immersed in the tray. The level of the water can be raised or lowered by the use of a draining cock. A ripple in the water, now and then, will add a few more thrills.

(6) With the cast shadows of the objects as thrown by (*a*) artificial light from different

points, (*b*) ordinary window light, and (*c*) direct sunlight.

(7) By looking at the objects placed either above or below the eye-level. In such a case we have to look up or down at the objects. The axis of the cone of our vision in each case must fall at right angles to the plane of the PERSPECTOGRAPH, and consequently, of the drawing board. The PERSPECTOGRAPH is adjustable by screws, to tilt forwards or backwards, so as to enable us to direct our vision to fall at right angles on the apparatus (FIGS. 1 & 2).

This appears to be a formidable list, but remembering that it has taken centuries to unravel the mysteries of the art and science of Perspective Drawing, and that if we wish to learn all about it in a short time, we may as well take some extra trouble. The time required for mastering the technique of the seven points mentioned above is practically much less than what we take to read and write the alphabet.

The third stage should consist of drawings done entirely by guess-work, taking only the scaled sides of the frames as guide lines. It is, therefore, evident that the squared glass and the slipped-in cardboard are no longer required. They should be taken out of the respective

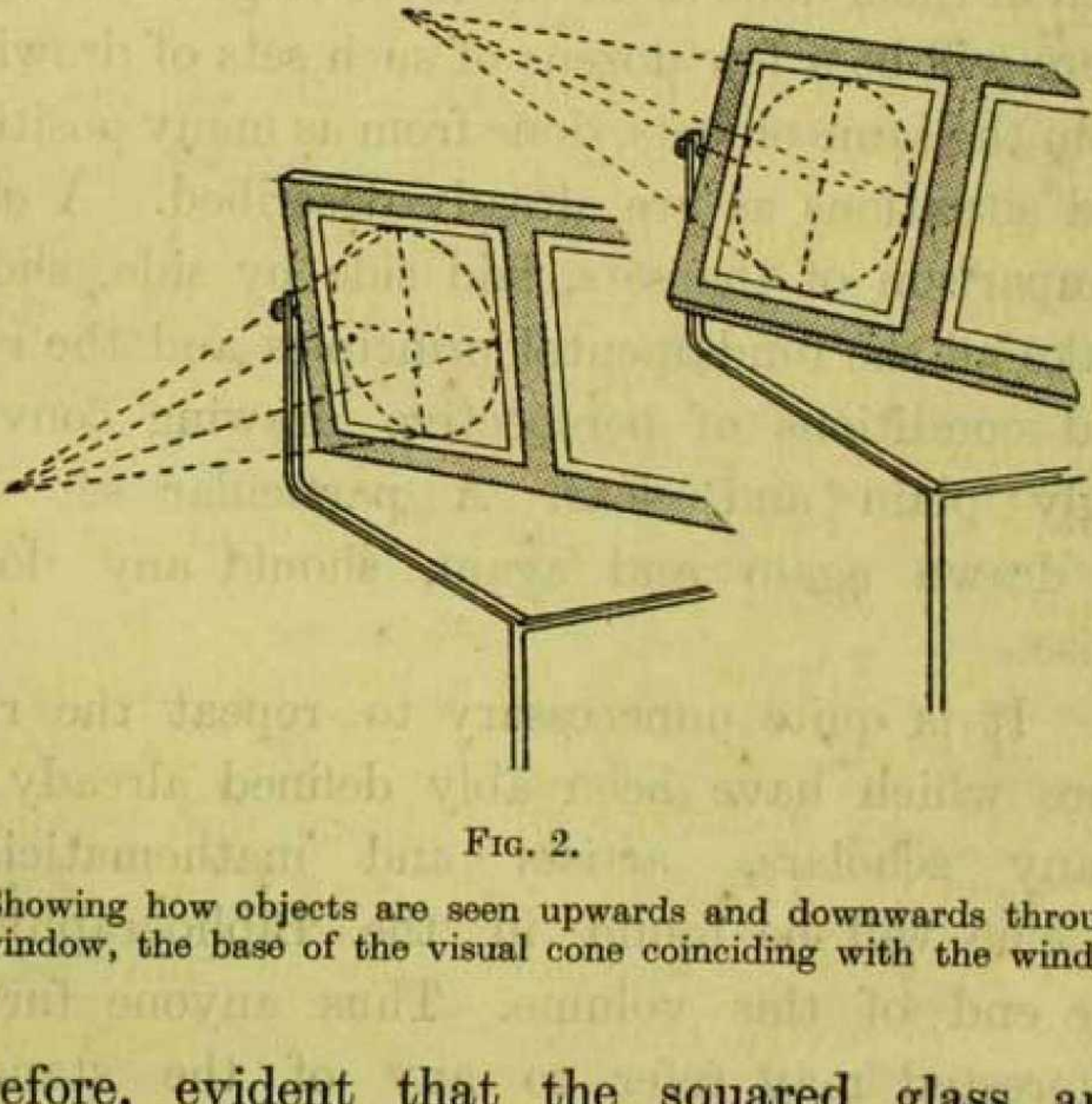

FIG. 2.

Showing how objects are seen upwards and downwards through the window, the base of the visual cone coinciding with the window pane.

frames. All the drawings which were done previously, should be done over again by the guess-work method. It will provide a set for each of them done in all the three stages. Perhaps there will be a few dozens of such sets of drawings from the same objects, done from as many positions and situations as are already described. A close comparison of the sets, laid side by side, should make all the fundamental principles and the rules and conditions of perspective drawing convincingly plain and clear. A particular set may be drawn again and again, should any doubt arise.

It is quite unnecessary to repeat the rules here which have been ably defined already by many scholars, artists and mathematicians. A clue will be found in the Bibliography at the end of this volume. Thus anyone further interested may refer to any of the standard books on the subject, particularly those by Hatton, Vicat Cole, Lutz and others. As the rules are all to be verified by the beginner, it is desirable to have a practical guide book for reference—and this little book may also serve the purpose.

My intention, at present, is to put forth certain suggestions that can be practically followed by anyone familiar with the rudimentary principles in the art of writing the characters of an alphabet. The first and the last lesson in the science of perspective is that THE NEAREST OBJECT IS THE LARGEST, which, I expect, will be abundantly clear from the exercises as suggested under the three stages. Conversely, the sizes of objects appear to diminish as they recede from us. And it will be seen how in the distance uneven or complicated shapes are reduced to simple ones. As a matter of visual fact, a simple object is distorted from near vision, while an uneven object at a distance appears to be smooth. The same near object, described by two friends from different standpoints, even slightly apart, will produce disagreement, even vast, but it may be described by them almost identically if their standpoints are at a distance. The silver lines that seem to shine on the sea when viewed from a distance are mostly composed of mighty breakers dashing on the beach. It is, however, one thing to see the vast expanse of nature as revealed before us through the window, and to know that the objects must appear smaller in our vision as they recede from us, and quite another thing to be able to reproduce the scene both properly and adequately. We can, therefore, in the very beginning realise the truth that the law which lies behind the meeting of the sky and earth, one above and the other below the eye-level, on the horizon, will evidently affect all bodies belonging to them. Sizes diminish and objects vanish according to the laws of appearance, as they recede towards the horizontal line which lies directly at the eye-level as we take our stand to observe the object.

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Thus there is no difficulty either to observe or to realise that near and far objects are large or small according as they are near or away from us. The railway tracks and the trains on them, with their wheels and all, therefore, seem to be reduced into a tiny speck in the distance, irrespective of the ground being level, or inclined uphill or downhill, or winding away to the right or left. Of course, the mathematically precise objects show their dimunition quite obviously, but natural objects with which we have to deal later, in their infinite variety, hardly show any inclination to be bounded by precise straight lines or regular curves.

As laws of perspective must affect every visible object, our task becomes supremely interesting in catching the most delicate and ever changing curves in nature. And it will not be so difficult after all, if we try to follow the writing on the window without shifting our point of view. The draughtsman, while examining the

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sets of drawings, would no doubt scrutinise the discrepancies that must occur, and would soon find how previous impressions about forms regarding their sizes and relations to each other, and also to himself, were principally responsible for the imperfect rendering of the solid object on a flat surface. And although objects change their contours whenever we shift our position, how strangely our original impressions as to their shape remain unchanged! This puzzle has first to be solved, before we can confidently proceed to further problems.

We know that the top of a table or the cover of a book is almost always rectangular, and that the rim or the base of a tumbler, circular, but that on rare occasions do they appear as such to our view. Thus there is a vast difference between the notions we have already formed about objects, and their images as they appear before our eyes, from which we must make all the inferences. How our perception is constantly corrected by innumerable data around us which are apparently incorrect! And if to see is to believe, how much do we not disbelieve the appearances, from which inferences are drawn! What chance indeed has visible actuality against concepts in this connection?

In the comparative studies of the sets of drawings, it becomes quite apparent that our psychological error, or inertia, and not our physiological defect, is the root cause which incapacitates us to draw and show on a plane surface the truly receding aspect of nature. This inertia has got to be overcome. We are too prone to follow the dictates of our imagination, fancy, dreams, or memory impressions. To follow the contours consciously and intelligently, as they appear to project towards us, *i.e.*, foreshortened, requires an amount of alertness for which we seem hardly prepared. Perhaps the notions formed in our childhood, through both imperfect tactual and visual experiences, as to the shapes and sizes of objects and their relative distances from us, which are safe and convenient for our everyday life, we as draughtsmen become blind to the correct values of optical sensations—and thus remaining just satisfied with our childhood experiences is a colossal loss for humanity in this sphere. It is not infrequent that an artist is too unduly admired and pampered for being just able to render the solid object on a flat surface, a capacity which anyone willing to get over the arrested development of childhood can possess.

Take an ordinary example. A glass of water is placed on a table. We do not see the visual image of the rim of the glass as a circle but as an ellipse, the minor diameter of which may appear very much shorter than the major. Now, in trying to hold the glass with our hand outstretched, we do not mentally take into account only the visible portion of the shortened image of the glass but its actual size. To catch the glass, therefore, our fingers are stretched much wider than the mere elliptical vision of the glass rim warrants. This is due to a *preconception* of the shape of the glass, and our properly outstretched fingers do not cause a domestic tragedy. But a tragedy does occur when we try to represent the tumbler placed on a table, obsessed with the impressions or concepts which make ordinary life so safe. Then we blame not the tools as bad workmen would do, but, modestly enough, ourselves ! My contention, therefore, is that the ability to draw resemblances cannot be of any real difficulty, because psychological errors, once detected, need not be persisted in, when a mere mechanical contrivance, the PERSPECTOGRAPH for instance, can be of such assistance. Errors would cease to be terrors through practice, and the powers of both the eye and the hand being co-ordinated, it can be expected that one would be able to improve and draw almost automatically, perhaps significantly.

Advanced students will, of course, increase the sizes of the guiding squares till they can manage with only a line or two (vertical and horizontal), or even dispense with the squared contrivances altogether. A simple way of doing this in the beginning, by such students, is to decide upon the position and nature of the lines required, and then mark them with some removable stain (red writing ink is quite suitable) on our windows. Arranged geometrical objects should also be given up, once we are initiated into the fundamental rules. I would, however, recommend the use of a few complicated objects, such as one or two models of a bridge, a building, or a staircase, for constant practice and reference. If possible, a fairly large glass model of a perfect alum crystal may also be procured. Gazing through the PERSPECTOGRAPH would indeed open to us most of the directions, sizes and relations of lines, *i.e.*, their relations in perspective.

Before the student goes for outdoor studies, he will, of course, do well to study interiors, street scenes, bridges, etc., so that the principles of the art of perspective drawing may be thoroughly grasped by him. The mere vision in perspective of an object does not disturb us, but to translate it in perspective on a flat surface requires all our concentrated attention and quickened grasp. To pursue her ever-elusive flow of lines, nature awaits a sure hand and a keen sight.

The means described here—to follow the notations directly from nature's visual music—may have an analogy in "Phonetics," which is employed today in learning a language—first, by co-ordinating the powers of hearing and speech, the grammar coming next for constructional unity. Similarly, the PERSPECTOGRAPH is devised to guide the hands to follow what the eyes first discern through the glass side of the apparatus. The science of perspective, as deduced from the experiments, and if necessary, reinforced by consulting the mathematical laws involved, can be next made use of for such a unity as may be required for interpreting nature in one particular aspect. The PERSPECTOGRAPH may, in a way, be said to have some relationship with the apparatus designed by Albrecht Dürer in 1525. The hints thrown out by early masters are, more often than not, most useful for further research, and I do not see why Lutz should think so lightly of Dürer's apparatus. "This invention," he says, "is perhaps more to be considered as a curiosity than as a practical affair." (*Practical Drawing* by E. G. Lutz.)

CHAPTER III

PICTORIAL LIMITATIONS OF THE VISUAL FIELDS

THE main advantages of using a mechanical device for improving our power to draw adequately being spoken of in some details, we may now discuss the reasons for limiting the size of the window to one foot square, and the picture plane to ten inches square. As already mentioned, the picture plane should be ten inches square when placed at an arm's length, *i.e.*, approximately two feet away from the eyes of a man of normal height. At half-arm's length, or ten inches away, it should be four and a half inches square. This is indeed limiting the angle of vision to 25° approximately. The reason is this. If two sides of a triangle, subtending an angle of 25°, be drawn from the eye and produced, it will be observed that they will meet the base line on the PERSPECTOGRAPH (and consequently, that on the picture plane on the squared cardboard), the length of which base line will be either ten inches or four and a half inches, according as the plane is at an arm's length or half an arm's length. It will also be observed that the shortest distance between the eye and the picture plane, which is really the length of the line bisecting the 25° angle at the eye and falling

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on the base on the picture plane—in other words, the perpendicular from the eye to the base—is either two feet or ten inches, *i.e.*, an arm's length or half-arm's length. The principle involved can be readily understood by drawing in full size on a sheet of paper the triangle (with the perpendicular) as mentioned above, and placing the PERSPECTOGRAPH and the eye at the two ends of the perpendicular. The length of this perpendicular is, for all practical purposes, that of the line between the eye and the pencil tip held at an arm's length or half-arm's length. A little practice will easily make the beginner an adept in using this method. If an accurate solution of this triangle be desired, it can be easily made with the aid of the first few formulae of trigonometry.

A tall or a short man should, of course, find out his own arm's length, *i.e.*, the distance from the eyes to the pencil tip with the arm outstretched, and calculate the size of his own window. I think, however, that a ten-inch square would suit almost everybody barring the exceptionally tall, but it is better to know exactly one's own limit in this connection. The main reason for thus limiting our zone of vision to much less than what we believe we can see distinctly, is to train our eyes to see only as much drawable surface as we can truly and easily accommodate. It will be found by practice that the simple span of 25° angle should be the outermost one for the purpose (FIG. 1).

I am concerned here mainly with that part of the theory which can be visually verified. To test this, one should attempt to draw the images outside the limits of the ten-inch square, up to the corner of the one-foot square frame, under conditions already mentioned. He will soon find himself compelled to change his single point of view, and look sideways, upwards or downwards, beyond the simple and easy span of vision. It will also be found how the extreme corners call for adjustments which strain the eyes more or less. That we cannot do so with impunity is very soon proved. It, therefore, follows that only the portion of nature which can be easily accommodated and adjusted within our vision, can be depicted to the best advantage and with the greatest emphasis.

Harold Speed (*The Practice and Science of Drawing*) recommends us to observe things as a flat subject through a 7″×5″ cut-out of a cardboard with squares made by threads. Clegg (*Drawing and Design*) suggests an 8″×5″ aperture. But while such a cut-out makes one measurement definite, it leaves the other, the point of interception from the eyes, too indefinite. Besides, the cut-out should be a square from which the student may be able to choose the size of his own picture plane. The unsuspecting student may, therefore, go on committing blunders by holding the cut-out cardboard, as recommended by Speed or Clegg, either too near so as to include all the visual fields, or too far to serve his purpose. Guptill's "view-finder" is not of much help for the same reason. Many a picture, even by able artists—especially of, say, tall buildings, a crowded street vista, or a winding river in the foreground—suffer from this defect for introducing elements more than what can be seen by a single vision and commodiously admitted. Compilation of images seen from more than one point of view, is the result of unsteadiness of both the eye and the mind, and true representation becomes ever so great a problem, when hands already untrained and unsteady are to obey their dictates as well. Sir Charles Holmes (*Notes on the Science of Picture-Making*) says, "The great thing is to avoid the doubling of the triangle, by an arrangement which leads the eye inwards to two separate points. We are then placed like a spectator at an angle where two galleries meet, who can look down both of them. In practical life such a position is often serviceable;

in pictures it leads to a division of interest which is just the reverse." But the question still remains : How to achieve " the great thing " ?

There is, therefore, no point in drawing objects lying outside the range of what we can see right in front of us as permitted by a single simple angle of vision. The visible world is too vast and spacious for us, and we should be content to explore only the portion which we can truly and easily grasp at a time. How feelingly and significantly has Rabindranath said, " Remember, my friends, what is huge is not great " ! Oriental artists, in their love for depicting the unbounded vast expanse of natural scenery and sequential events, solved the problem both beautifully and intelligently, by painting in scrolls where the condition of enclosing the picture in a frame was not imposed.

Another way of testing the theory is to observe enlarged photographs. The camera lense* usually takes wider pictures than is spoken of here. Such enlargements copied too faithfully

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* Except in the latest movie camera.

are invariably insipid. They are loaded with seemingly truthful records and are full of unsuspected distortions. Of course, there are clever photographers who can make good use of the camera to produce pictorial qualities, but then they emphasise certain features and eliminate others to attain their object.

It is no doubt a fact that our visual field extends to more than 100°, but it is also a fact that all colours cease to be distinguishable outside of 60°—and to draw as much as that (60°), we have to roll our eyes from side to side. The result is a panorama of a series of patchwork pictures, however well executed and assembled together by the application of misplaced vanishing points, lines or traces, etc.

The poet may describe in words the stars in the heaven and their reflection in the water near by ; he may also praise the beauty of meadows and dales resplendent in varied colours and with flowers, putting them all together ; but the artist, with his paint or pencil, cannot and should not attempt such a juxtaposition, which can but produce, at its best, a kaleidoscopic vision containing peeps of doubtful values and loose combinations. It is also to be remembered that the picture plane can only describe a field of single vision which is limited by space, as distinguished from a poet's or a musician's vision which swims and flows in measured time. To convey the sense of a compact whole, the vision to be transfigured in the drawing will have to be confined within a definite compass and it can be verified by anyone, as I have mentioned before, that the span of 25° is the limit of our distinct and 'commodious' vision.

Truly speaking, we can focus only on one point at a time. This point, *i.e.*, the centre of base of the visual cone, is at the other end, away from the eye, on the shortest line between the percipient and the perceived. We have to find out, therefore, a particular area of the circle around the centre for our specific purpose. In the field of vision, there may be observed three areas or zones, according as they are the most distinct, distinct and indistinct ones. These zones, of course, merge into one another imperceptibly.

Another important point to consider is the limitation of the visual fields for colours. All objects in nature possess what we perceive and call a local colour, which is visible in a manner more or less modified, according as when and where we see an object. It is true that only an area or zone covered by an angle up to about 25° of view is clearly visible with colours in all their varied combinations. This is what is known as *the visual field for Green.* Beyond that there is another area which extends up to about 40°, known as *the visual field for Red,* while a further area up to 60° is *that of Blue.* Outside this area, again, is *the field for White* which extends up to 104°, where our view stops (FIG. 3). It should also be noted that the field for

Green almost coincides with the area of distinct vision, round about a 25° field.

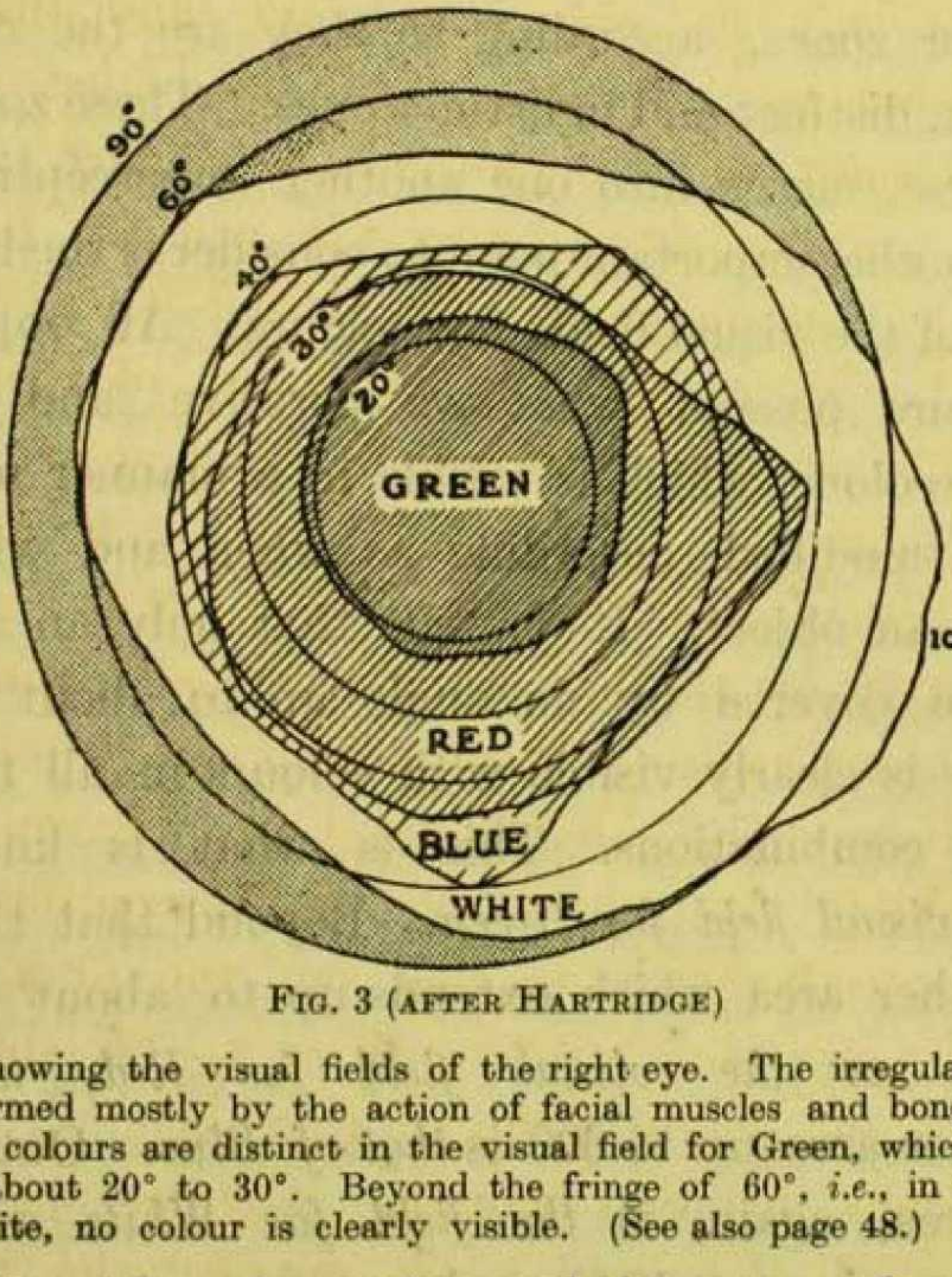

Fig. 3 (after Hartridge)

Showing the visual fields of the right eye. The irregular shapes are formed mostly by the action of facial muscles and bones. Most of the colours are distinct in the visual field for Green, which ranges from about 20° to 30°. Beyond the fringe of 60°, *i.e.*, in the field of White, no colour is clearly visible. (See also page 48.)

Our binocular vision and the power of our eyes to adjust and adapt themselves, constantly and with ease, do not make us conscious of the limitations mentioned above. But the artist *who will maintain the same standpoint* (and this is important) for his specific purpose, must take into account the different zones, colours, their extent and other varieties. It will be found that the circumference of the circle of 25° angle hovers round the borderland of distinct and indistinct fields (the most distinct visual field being limited to about 5°) ; and that it goes just beyond the visual field for Green. This might interest those who are also scientifically minded.

Our eyes are wonderful organs inspite of imperfections. They have natural arrangements for adaptability to almost all our susceptibilities. One has, therefore, to find out the limitation of one's own susceptibility, so as to be able to express and enjoy fully to that extent.

I must mention here that Architectural and Mechanical Perspectives are outside the scope of this book. Without referring to visible nature at all, an architect can, on the basis of the knowledge of actual position, shape and measurement, correctly delineate an object to mathematical precision. But often some special needs have to be satisfied. An architect then will, perhaps, choose the widest angle to serve his, or his client's purpose of showing much more than is justified. But such a license is never approved by architectural authorities. It is interesting to note, for instance, that both the Maltons, father and son, " advise that the angle of view should never exceed from 53 to 60 degrees ; the father recommending an angle of 45 degrees as the best " (Gwilt's *Encyclopaedia of Architecture*). Middleton has recommended the further narrowing down of the angle to 35° to avoid distortions.

Some painters, however, with a preference for the monumental often forget their limitations. One aspiring to draw the Liverpool Church or the Eiffel Tower within one complete vision, has either to place his easel so far away as to lose the details altogether, unless he is possessed of the most extraordinary pair of eyes for distant vision. Otherwise, he must use a field glass or even a telescope for the purpose. Similarly, if one must draw a 100° angle view, he can use a diminishing glass, made to order, to compress the entire view close to his eyes. We may group them together with the architectural or mechanical draughtsmen. In case an artist attempts to draw the Liverpool Church from a near position, he will have to look heavenwards too often to produce any plausible result. But the result will undoubtedly be the effect of practically isolated portions drawn from separate viewpoints and then patched together. Another artist, trying to draw the Dehra Dun Forest Research Institute (an exceptionally long structure), say from 100 feet away, and looking towards the middle of the façade, will be compelled to violate the rule that lines parallel to the picture plane do not meet, because objects must appear smaller as they recede, no matter which way. The stars above, the ship on the horizon and our faces as seen reflected in a deep well, all prove the visual fact that THE FARTHEST IS THE SMALLEST, AND THE NEAREST THE LARGEST. When we are walking along a narrow street, very tall buildings on either side of it will tend to meet somewhere right above our head, but much below a point in the heaven which is immeasurably distant. At such a distance some stars that are thousands of times bigger than our sun—not to speak of the earth or of the tall buildings—appear as tiny specks of light. The distance is the reason for this phenomenon.

It is really the necessity to draw a unified picture that it becomes imperative to keep within a measured field of vision and not to step beyond the fringe of a simple and easy angle of view· Of course individual measures there must be, but they cannot go beyond the general measures. The advisability of confining our zone of vision within

25° at the utmost is, therefore, clear, where the 'defect of parallel perspective' is never pronounced. This rule should also be adhered to by artists, many of whose pictures would thereby gain in compactness, instead of losing it in ambitious width. Thus to heighten the stimulus and to get the most brilliant pitch in tone and colour, one must limit his field of vision. And an artist well conversant with the rules will be easily able to construct pictures, even conjecturally viewed from any angle he chooses. He will often do so, if he is inconveniently placed before the object he desires to draw.

The limitation recommended here may at first seem to be an unnecessary and irritating restriction to those who feel that they must go beyond. A few outdoor exercises through the PERSPECTOGRAPH would, however, prove how extensively can an aspiring student depict a view in space, and how often would he not shorten even that limited span to get depth in his picture, which may extend to infinity right in front of him. It may be observed in this connection, how the artists of the Impressionist School gained an enduring compactness in their composition by limiting their angle of vision to somewhere near 25°.

Hatton mentions " dodges " practised by artists to avoid an over-extended corner, " which gets so wrong when far away from the centre of the picture." How one would wish that, while writing for art students, he would also recommend a definite span of the picture plane from the point of view, instead of lamenting over the ' defect of parallel perspective ' and would explain with illustrations ancient and modern, how the ' harsh ' effect caused by strict perspective rules, could be ' eased ' ! Honest realism should not stoop to ' dodges.'

Of course, there are bound to be some convenient conventions in picture-making, but the less we depend on them, the better for us. And it is also surprising, why Rex Vicat

Cole, writing such an informative book (*Perspective as applied to Pictures, etc.*), recommends an artist wishing " to paint a figure standing on a height—say a tower—and another at a base......to take up a position far enough away to include both without having to look up and down, so that the figures would appear to be the same height." An indication of how distant that position should be, would have been helpful to practising artists. FIG. 351 in his book, illustrating the distance, is rather unconvincing—the visual angle formed by the length of the figure at the base being almost double that formed by the figure on the tower. And it seems to me that J. Hullah Brown's advice to the " young draughtsman......never to bite off more than he can chew," is too valuable to be given only to him. His elders can also profit by it. It has also perhaps escaped the notice of Solomon J. Solomon, who, while stressing the " utility of drawing by the spaces left," to realise the principles of foreshortening, advises to place something against the object to be drawn, for the purpose. The chapter on "The Round Reduced to Flat," with the accompanying plates in his famous book (*The Practice of Oil Painting and Drawing*), is referred to in this connection.

Sir Joshua Reynolds advises us to draw as much as we can "commodiously see," but this also falls short for practical purposes. Vicat Cole refers to a passage from Reynolds which explains concisely the purpose of perspective, namely that "the rules of perspective, as well as all other rules, may be injudiciously applied; and it must be acknowledged that a misapplication of them is but too frequently found even in the works of the most considerable artists. It is not *uncommon* to see a figure on the foreground represented near twice the size of another which is supposed to be removed but a few feet behind it; this, *though true according to* *rule, will appear monstrous.* This error proceeds from placing the point of distance too near the point of sight, by which means the diminution of objects is so sudden as to appear unnatural, unless you stand so near the picture as the point of distance requires, which would be *too near for the eye to comprehend the whole picture*; whereas, if the point of distance is removed so far as the spectator may be supposed to stand, in order to *see commodiously*, and take within his view the whole, the figures behind would then suffer under no such violent dimunition." (*Italics are mine.*) With due deference to Sir Joshua, I would like to observe that coming as he did 300 years later than da Vinci, it was time enough for him to reconsider the validity of the rules which permitted monsters to be made of human figures in pictures as, evidently, was not uncommonly perpetrated then, and to modify such rules that were already proving to be bizarre in practice. Since then, the Goddess of Beauty, I am afraid, has stifled many a sigh at the corroded gate of Perspective Laws.

We must limit the boundary of the picture plane; and nature very kindly gives us a warning pull whenever we tread on soils that are not our own. It will be found that nature gives this warning even before the 25° span is reached, that is, when the visual field for Green is about to merge into Red. It needs hardly any mention that we should concentrate our activities only where the distinctly visible colours are present with their varied combinations, obvious or not. Such a presentation is found only in the field for Green, which is approximately the field covered by the 25° angle (FIG. 3). It should also be noted that to tackle the corners of the foreground is always a great problem with artists, and writers on composition, who invariably regard them as danger zones, suggest many remedies. The unbalancing pull of a wide angle view seems to be one of the main reasons for this disturbing factor in the corners. "Some artists like Corot," observes Sir Charles Holmes, "have evaded its (foreground) obtrusiveness, by including nothing

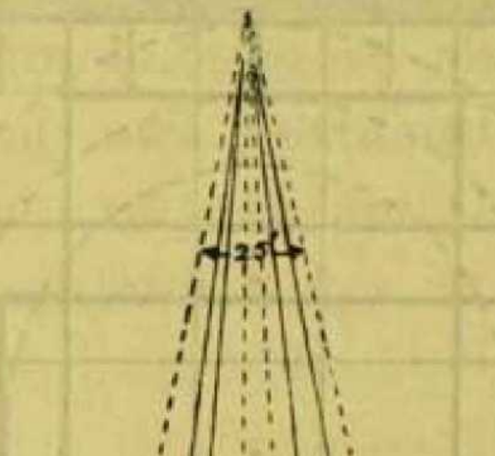

FIG. 4.

Showing how the base of a pyramid, cut off from that of a 25° cone of vision, makes for a picture plane.

that was less than two or three hundred yards away from their easels."

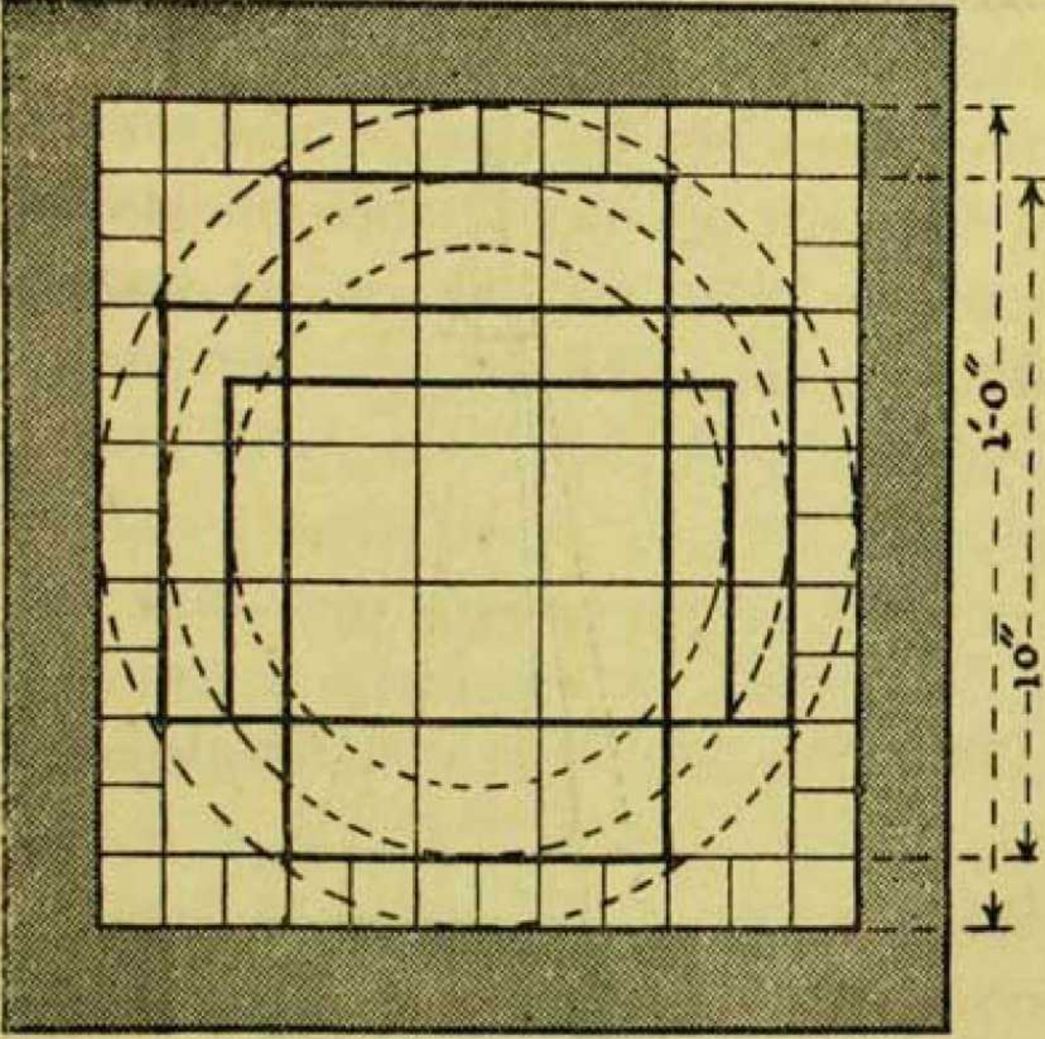

FIG. 5.

Showing how, in the picture planes of usual size (rectangles in thick lines), some extended corners are automatically cut off from the cones of vision, which are also further narrowed down.

All these reasons support my contention to limit the visual angle to 25°. The pictures cut out from that circled area will be in any case further narrowed down as so many bases of pyramids cut out of the bases of the visual cones (FIGS. 4 & 5). My grounds are indeed strong, and the reason for quoting so many authorities is not to fortify my own position, but to convince those readers who may be apt to disregard the views of a mere painter.

CHAPTER IV

PERSONAL RESPONSE TO THE IDEA OF PICTURE-MAKING

WE shall now proceed to examine if the PERSPECTOGRAPH can be utilised further. I have found that it can be of some use in regard to composition, which is supposed to be an exclusive jurisdiction of artists. A mechanical device as such cannot, of course, satisfy the spiritual desire for designing. But an element of constructional unity being always present in the drawings done in the manner so far described, we may also try to discover the elements of beauty in them, before we proceed to the problems of invention. Nature is resourceful, and if facts are sometimes stranger than fiction, let us not quite despair in our quest.

I would at the outset lay great importance on the intuitive response to the idea of the beautiful in an individual; and taking this as the most effective argument in my favour, I would advise my reader to fit in two slides, vertical and horizontal, to our window, so that they may be made to move easily at our discretion to form rectangular frames, as is usual with pictures (FIG. 6). Thus cut out, many awkward corners will be eliminated. It will be seen that one particular proportion of the frame, formed by moving the slides without any preconceived idea about the composition, will show the view at its best, not with absolute truth but with that which satisfies an artist's own intuitive sense of beauty.

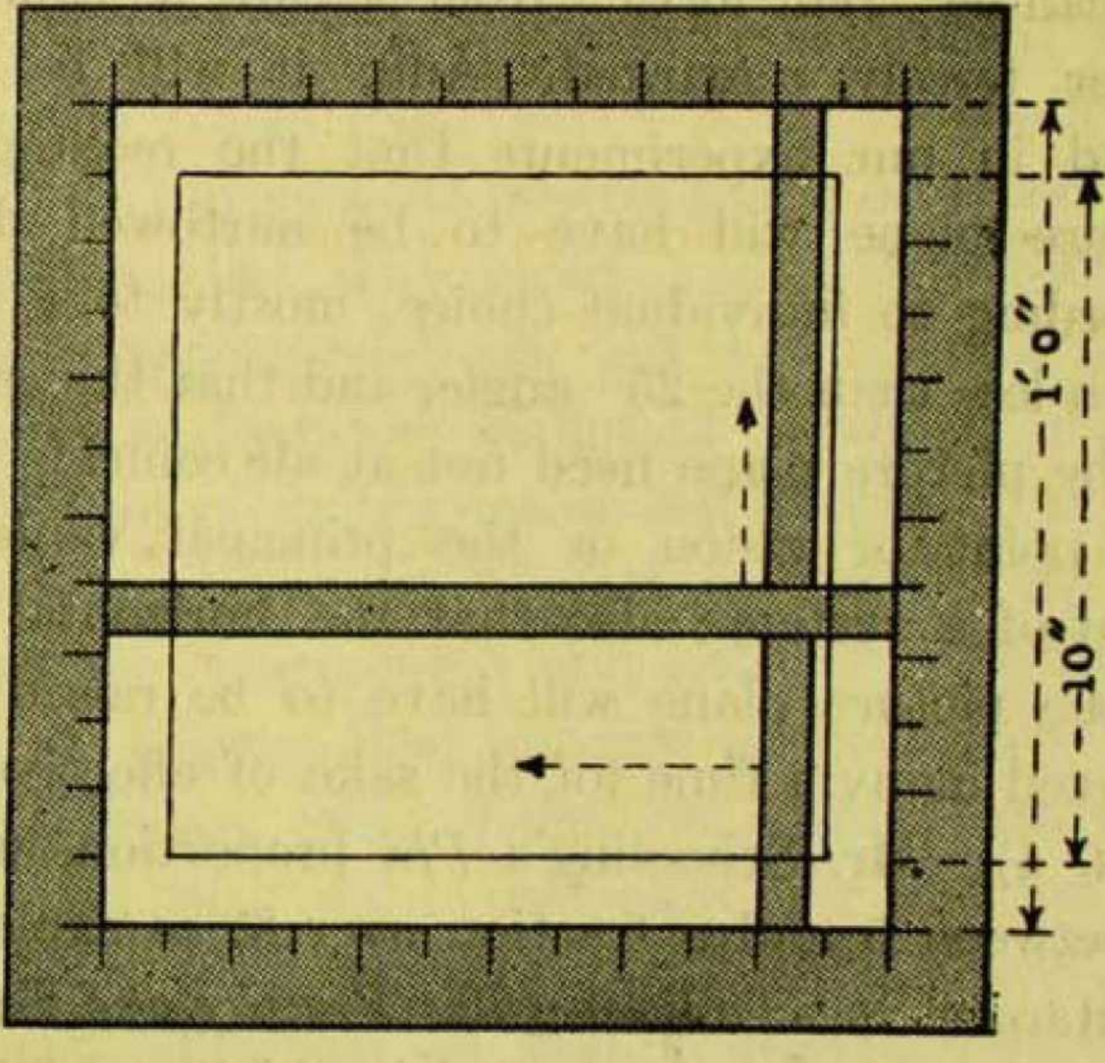

Fig. 6.

Showing how the slides in the window can be adjusted to form the picture planes, usually rectangular in size.

A few such exercises will show that there can be no fixed rule to make a picture look effective, and that laws, as Sir Joshua remarked, do not make pictures. They will also reveal how Art can be " rent forth " from Nature, as Albrecht Dürer tersely remarked. And, it will be soon found in our experiments that the rectangular picture plane will have to be narrowed down according to individual choice, mostly to a span much less than the 25° angle, and that the centre of the picture plane need not at all coincide with the point of vision or the principal vanishing point of a system ; also that the horizontal line in the picture plane will have to be raised and lowered many a time for the sake of effectiveness (Fig. 4). Mr. Schooling's *Phi* proportion, which is between 5 and a fraction over 8, as explained in Harold Speed's book (*The Practice and Science of Drawing*) may be studied in this connection.

We may further our studies with still more interesting experiments in space composition. For this purpose, the preliminary exercises should be confined to finding the most agreeable distance in looking at a particular view through the PERSPECTOGRAPH. By taking simply a nearer or a further point of view, we can realise that a particular object measured and rhymed within a scaled frame looks at its best. Secondly, we can, by shifting some objects singly or collectively, find out that they group and match better in different space relations, and that there is almost always at least one situation in which a group will behave with entire satisfaction. On the other hand, studies of patterns created by ever changing chiaroscuros and colour harmony will lead us a great deal towards perfecting our ideas about space composition. It needs hardly any mention that we do not shift our position until we have explored one aspect exhaustively, out of the million-faced reality that hovers around us. Indeed, there are as many realities or idols as there are eyes to look for them or hands to carve them out.

It may also be realised how little we need to invent, if we can discover significant patterns in the visible world that remain to be transfigured on the picture plane. A representation of a slice of nature in her infinite spacio-temporal aspect, chosen through this adjustable window solely by individual determination, may bring forth art forms that cannot be otherwise realised. This determination by the individual, being conditioned, can hardly degenerate into mere wilfulness. If the hand can be so cultivated as to be able to represent what the trained eye can discern, nature will cast off many of her mortal elements, and, almost annihilating her material self, allow her immortal form to be emancipated by a devotee.

I have, perhaps, greatly emphasised verisimilitudes, ridiculed today as a sort of imitation or mimic show, but many a hidden truth may lie behind such mimic shows as Gottfried Semper has, according to Prof. Baldwin Brown, contended. It is also interesting to note what

Baldwin Brown says, namely that " the imitation is only made artistic by the operation of the controlling law of composition and this already begins to work when a representation of nature has to go in a certain space." It will, of course, require a well directed and continued application to improve the technique, so that the too-mortal fleeting sparks, as emitted by the impact between the individual and nature, can be preserved in a bounded space with something of its own undying energy. And if such a devotee wishes to express his experiences because he must enjoy newer experiences thereby, he need not trouble himself about the canons of æsthetics.

I cannot, however, speak here of the soul-stirring, innermost urge which may lead the Master Artist, because it must, beyond the limits of personal and impersonal considerations. Indeed, I am just speaking of some suitable means to master only the three-dimensional aspect of nature, and can say nothing of the fourth, *i.e.*, the "æsthetic dimension," as Dr. Ralcy H. Bell would call it. I feel, however, that some amount of force of conviction in individual choice can intensify resemblances "with accent and emphasis in order to express character and to reveal what is ordinarily called Soul."

Cultivation of the powers of the eye and the hand can only end in their co-ordination, for the simple reason that the hand of the same person will refuse to draw what his eye cannot see, and that he will give up either seeing or drawing, if his hand and eye fall out between themselves. And if one with a particular vision could describe with compelling clarity the glimpse of nature that appeals to one most, one will indeed be speaking in universal terms discovering "veins of hitherto unsuspected treasure—new meanings and values." After all, Art is man's one reaction to the presence of Nature. But, we do confuse too many viewpoints of ourselves and of others as well (past and present) and a hotchpotch of concepts and actuals is the inevitable result " crashing together in ruins."

I will now close with a few more suggestions to the advanced students. Simple tonal and colour studies can also be practised through the PERSPECTOGRAPH when the small squares are not to be referred to any more, and after a few exercises of lighted and less lighted spaces, as seen through the window (smoked and tinted transparencies of different depths being slipped behind the glass for the purpose), great many truths will be revealed about Aerial Perspective, which again need not be the privileged knowledge of the artists alone. A zealous student will also find this device useful in studying portraits. Portrait drawing is supposed to be one of the most difficult artistic pursuits, requiring the keenest perception and the surest hand. The little I can say on the matter is that simple, faithful portraits can be successfully executed, if two or three different depths of tone, beginning with the darkest, could be intelligently 'scribbled down,' leaving out the other visible peculiarities of the sitter as seen through the window. A line here and there may just be needed to emphasise or to eliminate some features, according to the choice of the student. He may also use a bigger drawing board or canvas as the picture plane by his side, with proportionately enlarged squares as his guides. Before he is sure enough to dispense with it altogether, he must, however, work out only through the window. The difficulty, as already mentioned, lies mainly on psychological and not logical grounds.

As pictures of such small dimensions, transfigured from 4″ or 10½″ windows, will not always satisfy the need of either filling up a certain wall space where the picture is to be placed, or of recording subtler modulations searched out of the deeper intricacies of nature, it may be found necessary to enlarge the studies to much bigger scales. A sensible draughtsman will not find it at all difficult to do so, should he be acquainted with a few geometrical rules and with some knowledge of the materials to be used. So long as the limit of the 25° area is not violated in the original, an enlarged picture of a controlled, ‘commodious’ view, however detailed, will always carry some potential elements for quite enjoyment; whereas pictures enlarged from wide angle studies are bound to include too many accommodating conditions, and ‘dodges’ have to be practised to make them presentable.

An ambitious imperial picture composed of regions “far from the centre of the picture,” as Hatton would say, will contain too many “extended corners,” requiring ‘dodges’ to overcome them. Such a work is bound, by the very decentralised nature of it, to cause uneven adjustments and adaptations. To enjoy, for any length of time, such compositions of divided interests held together in accordance with conceptual mathematical laws, will need the stimulation of certain nerve-centres and the benumbing of others, and if continued, this can only lead to the use of stronger stimulants and depressing agents until a stage is reached when distraction and not attraction will be the chief point of interest in a work of art.

All these may be considered by him who may, either as a professional training or as a recreation, like to " scribble down " a slice of his own chosen spot in the visible world that appeals to him intensely for even a mortal moment. He may also thus transform many a mere perspective and light and shade studies into experiences, illuminated and tempered with personal emphasis. And if he knows a little less of æsthetics and a little more of true perspective, he will do much better. I would even dare to ask him to forget what Roger Fry says—that " the worst painter of today can give to his picture truer perspective and truer light and shade than Giotto could, but this does not make him a better artist. The aesthetic value of a work of art is, in fact, independent of its factual contents." There may be a difference of opinion as to the realisation of æsthetic value, and a warning is certainly called for, at any rate to the beginner, who must not disregard the value of perspective and light and shade when he wants to draw from nature.

It is my firm belief that many a significant and vibrant pattern can yet be produced in the world of naturalistic art today, if such patterns are endowed with an intimate personal touch, enlivened only by one's own choice. A certain freshness is then the inevitable result. And it is not so difficult, after all, to take a few correct notes if we can shake off preconceived ideas, however fondly they may be cherished from our childhood and found useful in more than one way. Is it at all a problem to trace the figures enclosed within a few one-inch squares on a transparent surface before our eyes, and deduce the fewest of few laws that are involved in the science and art of perspective drawing?

In time, our dependence on both drawing from memory and with the aid of a mechanical contrivance has to be got rid of. By drawing from memory I mean here the continued practice of depicting figures of already-formed mental images. Such a depiction is due to mental inertia. And a prolonged dependence on a mechanical device denotes a state of physical inertia. Both the lines of least resistance should, therefore, be overcome. *It is imperative always to be alert*, so that the point of view remains undisturbed and previous notions or concepts may not blur the fresh experiences that nature is ever ready to reveal. That mighty enchantress may be kind to a daring and chivalrous devotee.

We have so long attributed the discovery of the laws of perspective, in their present form, to da Vinci. But they had been deduced, crudely though, about half a century before him by Paolo di Dino (called Uccello, for his love of birds), who not only burnt the lamps from midnight to dawn, inspite of his wife's entreaty to take rest and save a little more oil, but also, according to Sir Charles Holmes, burnt the boats in which his art had to sail, owing to his " enthusiasm for a particular principle." This little historical reference is made to explain how the minds of artists and researchers were working towards expanding human knowledge during the Renaissance.

Lastly, it will be found that no new laws or theories have been propounded here. It is indeed superfluous to speak on the advantages of concentrating on one's limited sphere of activity and to explore it to the utmost.

The world is indeed indebted to the Western people for the amount of knowledge they have imparted in connection with the theory and practice of perspective drawing. But somehow an enthusiasm for extensiveness seems to be so ingrained in them that the limitations of the visual fields are often overlooked, and a vast number of pictures have been produced with panoramic and mosaic visions. There are, of course, exceptions, and artists of all ages are known to have worked out their problems, having quite intuitively chosen a very simple zone of vision. As already mentioned, the artists of the Impressionist School hardly ever wanted to look out of the fringe of the visual field for Green. They did so, it seems to me, more out of a good sense for picture-making than for the purpose of propounding any theory. But many of the Western artists have become so restless and dynamic of late that they cannot find enough time to exploit the possibilities of the above School. Instead, there have sprung up many schools, and although a somewhat widespread and honest search is evident, almost all of them seem to be in despair.

The malady appears to be global, and art movements everywhere seem to be caught in a violent spin of both concentric and eccentric visions. If art is human at all, the strain and pull must soon reach the fatiguing point. I think, Salomon Reinach is, after all, right in his forecast of the coming of a reaction and return to an art of "greater reticence, discipline and self-control." But leaving artists and their problems alone, I hope there will always remain a few simple naturalistic painters—not professional artists always—who would limit their field of vision to what is within their truly 'commodious' view and would care rather for the certainty of "immediate experience." They may require a simple guidance to the art and science of perspective drawing, and with this end in view, I have explained at length the method which can claim at least the single virtue of not being learned. Merely a by-way, though somewhat unknown, is indicated only for those who are not "born artists." Indeed, the world appears to be too full of "born artists" today. But there may be some chance for others now, and if this treatise is found to be of any use to them, I shall be amply repaid.

9-11-2000

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